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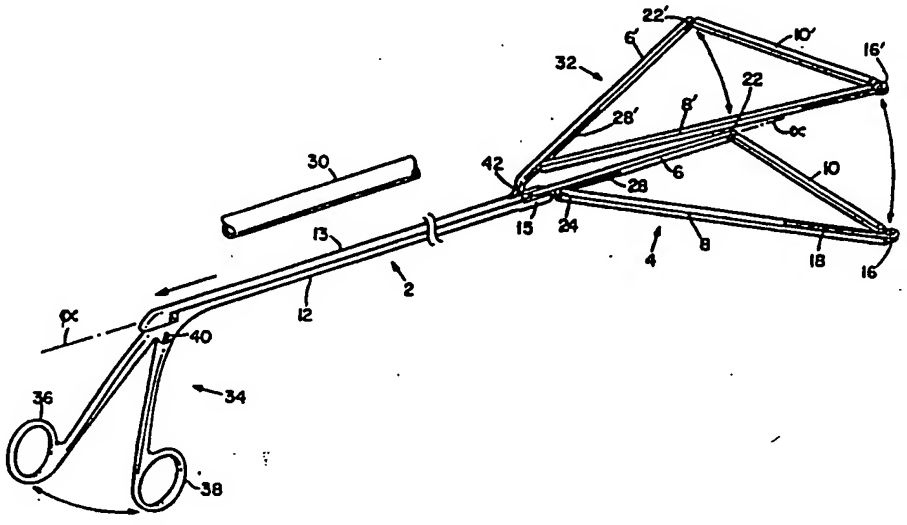
(54) Title: EXPANDING POLYGONAL SURGICAL COMPRESSOR



(57) Abstract

An expanding polygonal surgical compressor has a first planar frame (4) with at least three articulated frame members (6, 8, 10) extendable from a compressed configuration to an extended configurati n forming a polygon. A second planar frame (32) has frame members (6', 8', 10') corresponding to the frame members of the first frame. The second frame is pivoted to the first frame for movement from an pen to a closed or tissue compressing position.

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EXPANDING POLYGONAL SURGICAL COMPRESSOR

Background of the Invention

Endoscopic or video surgery is a relatively new medical procedure. It involves a surgeon making a small incision in a patient and inserting a lens and light source connected by cables to a video camera which, in turn, is connected to a monitor.

The endoscope, i.e., lens and light source elements are combined in a rod-like structure which is inserted in an area such as, for example, the abdomen or the chest. One or more other incisions are also made, through which functioning surgical instruments are inserted with their handles or equivalent operating mechanisms remaining outside the patient. The surgeon performs his work interiorally through the small incisions while watching the entire procedure on the video monitor.

The benefits from endoscopic surgery are numerous. Large scars are eliminated, the process, in many instances, is relatively bloodless and is much less traumatic to the patient than open surgery. The patient can leave the hospital in a far shorter period than after open surgery. This has economic benefits as well as emotional.

As indicated above, endoscopic surgery is performed with surgical instruments inserted through very small incisions. One problem is that the instruments themselves must be narrow enough to be able to be inserted into a patient without causing undue trauma. The surgeon may employ liners or mechanical orifices generally less than an inch in diameter which, themselves, are placed in the incisions.

Another problem encountered in surgery, endoscopic or open, is the necessity for operating on parts of the body which are moving as, for example, the heart or the lungs.

This is made even more complicated by the fact that both of these organs are in the chest cavity and the thoracic surgeon, by necessity, must enter the cavity through incisions generally made between the ribs. Thus arises the dual objective of this invention of providing instruments which are narrow enough to enter between the ribs and which are capable of manipulating moving organs such as the heart or the lungs. It is to these objectives that the present invention is directed.

Summary of the Invention

The invention resides in an instrument for use in endoscopic surgery for compressing tissue or organs. The instrument comprises a first planar frame having at least three articulated frame members extendable from a compressed configuration wherein the members are parallel to each other to an extended configuration in the form of a polygon. There is a second planar frame having frame members corresponding to the frame members of the first frame. The second frame is pivoted relative the first frame for movement from a substantially open position wherein the frames are at an angle with each other in position for gripping tissue to a closed or tissue compressing position wherein the planes of the frames may approach parallelism.

When the members of each frame are in their closed or compressed configuration, they are essentially parallel to each other, and when in their extended configuration, they form a polygon with the same number of sides as the number of frame members.

There are manually operated means in the form of scissors-like gripping handles for moving the frames between the open and closed positions.

A tube or sleeve may be employed to urge both frames into their assembled positions for inserting the instrument into and removing it from an incision in a patient.

In one embodiment of the invention, the means for moving the frames between their compressed and their extended configurations are cable operated means which permit the formation of a polygons of varying sizes at the will of the surgeon.

In another embodiment of the invention, the frame members are automatically opened when the sleeve has been removed by spring means attached to at least two of the frame members.

The above and other features of the invention including various and novel details of construction and combination of parts will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular expanding polygonal surgical compressor instrument embodying the invention is shown by way of illustration only and not as a limitation of the invention. The principles and features of this invention may be employed in varied and numerous embodiments without departing from the scope of the invention.

Brief Description of the Drawings

Figure 1 is a perspective view of an expanding, polygonal surgical compressor for use in endoscopic surgery.

Figure 2 is a side view of the compressor shown in Figure 1.

Figure 3 is a view of one of the frames of the compressor in its compressed configuration.

Figure 4 is a side view of the frames of Fig. 3 in its extended configuration.

Figure 5 is side view of another embodiment of the compressor made in accordance with the present invention.

Figure 6 is a side view of one of the frames of the embodiment of Figure 5 in its compressed configuration.

Figure 7 is a view of the frames of Fig. 6 in open extended configuration.

Detailed Description of the Invention

Referring first to Figure 1, the invention is embodied in a surgical compressor having a substantially straight body 2 formed along an axis α. A first polygonal frame, generally designated 4, has at least three articulated frame members 6, 8, and 10. It will be understood that whereas the invention is illustrated in a polygon having three frame members describing a triangle, four or more frame members could be employed without departing from the scope of the invention. The more frame members there are, the more the polygon approaches circular configuration.

The first frame member 6 is oriented along an extension of the axis α of the body 2. It is rigidly attached to a lower, relatively immovable body member 12, by means of a clevis-like member 15. The remaining frame members 8 and 10 are angularly extendable from a compressed configuration as seen in Figure 3. In this configuration, the remaining members 8 and 10 are substantially in engagement with and parallel to the first frame member 6.

The frame members 8 and 10 are movable to an extended configuration shown in Figure 4 wherein they form a three sided polygon. Frame member 8 is pivoted at 14 on the frame member 10. A coil spring 16 having arms 18 and 20 secured to the frame members 8 and 10, respectively, tend to urge

the frame members apart. That is, from the Figure 3 to the Figure 4 position.

The frame member 10 is pivoted at 22 on the first frame member 6. A rider 26 which slides in a groove 28 in the frame member 6 is pivoted at 24 on the lower end of the frame member 8.

In the compressed configuration shown in Fig. 3, the rider 26 is at the upper end of the groove 28 and in the extended configuration shown in Fig. 4, it is at the lower end of the groove 28 under the force of the coil spring 16.

To maintain the frame 4 in the compressed configuration as shown in Fig. 3, a circular tube 30 is positioned over the frame member 4 and a second corresponding frame member hereinafter to be described.

A second polygonal frame 32 has frame members corresponding to those of the first frame 4. The parts of the second frame 32 corresponding to those of the first frame 4 and are designated by figures indicated as prime.

In a manner common to many surgical instruments, the movable body member 13 slides on the relatively immovable body member 12 and is operated by a hinged scissors grip generally designated 34. The scissors have a rigid grip member 36 and a movable member 38 pivoted at 40 on the frame member 12 which is an integral extension of the grip member 36.

The second polygonal frame 32 is linked to the movable member 13 at 42 to permit opening and closing of the frames 4 and 32. When open, the frames are oriented at an angle with each other for gripping tissue as seen in Fig. 2. They can move to the closed dotted line position with the second frame member 32 substantially superposed on the first frame member 4. Obviously, they will not completely close when they are gripping tissue or an organ. The tissue T lying

within the confines of the polygonal frame members may then be cut, stitched, stapled, sutured and the like. In this position, the tissue is held relatively stationary as compared with its normal moving or pulsating condition were it a heart or a lung.

Referring to Fig. 3, the tube or sheath 30 urges both frames 4 and 32 into their compressed configuration for inserting the instrument into and removing it from an incision in a patient. In the insertion process, the tube or sheath 36 would occupy essentially the position shown in Fig. 3. After the frames have been inserted through the incision into the body cavity, the sheath 30 is slid downwardly as viewed in Fig. 3 or toward the scissors-like portion until it occupies a position surrounding the body 2 while the operation is performed.

To remove the instrument, the frames 4 and 32 are moved by the scissors to their closed positions and the tube advanced upwardly from the Fig. 4 to the Fig. 3 position for removal.

Figs. 5, 6 and 7 illustrate an alternative embodiment of the invention wherein the spring 16 for extending or opening the frame is replaced by a manually operated means on the body for moving the second frame 32 to the closed position relative to the frame 4 to the open position. It employs a sheathed cable 50 having a finger grip 52. The cable core 54 extends outwardly of the sheath 56 through a guide 58 and is secured at 59 to individual cables 60 and 62. Each cable is attached to a circular slider 64, 64' as seen in Figs. 6 and 7.

After the instrument has been inserted through the incision, the surgeon pulls the finger grip 52 of the sheathed cable 50 toward him or to the right as viewed in Fig. 5. This causes the sliders 64, 64' to move downwardly

from the Fig. 6 position to the Fig. 7 position, thereby opening the frame members 6, 8 and 10. By use of this mechanism, the frame may be opened partially or fully, depending upon the size and shape of the tissue to be compressed or the size of the surgical field. Having thus opened the frames 4 and 32 the desired amount, the surgeon then actuates the scissors 34 to grip and compress the tissue.

Claims

1. An instrument for use in endoscopic surgery for compressing tissue or organs comprising:

a first planar frame having at least three articulated frame members extendable from a compressed configuration wherein the members are parallel to each other to an extended configuration in the form of a polygon;

a second planar frame having frame members corresponding to the frame members of the first frame; and

the second frame being secured to the first frame for movement to and from a substantially open position wherein the frames are at an angle with each other in position with the frame members in their extended configurations, to grip tissue to a closed or tissue compressing position.

2. An instrument for use in endoscopic surgery for compressing tissue or organs comprising:

a first planar frame having at least three articulated frame members extendable from a compressed configuration wherein the members are parallel to each other to an extended configuration in the form of a polygon;

a second planar frame having frame members corresponding to the frame member of the first frame;

the second frame being secured to the first frame for movement from a substantially open position wherein the frames are at an angle with each other in position for gripping tissue to a closed tissue compressing position;

manually operated means for moving the frames between the open and closed positions; and

tubular means for urging both frames into their compressed configurations for inserting the instrument into and removing it from an incision in a patient.

3. An instrument for use in endoscopic surgery for compressing tissue or organs comprising:

a substantially straight body formed along an axis;

a first polygonal frame having at least three frame members, a first frame member being oriented along an extension of the axis of the body;

the remaining frame members being angularly extendable from a compressed configuration wherein the said remaining members are parallel to the first member to an extended configuration wherein the frame members form a polygon;

a second polygonal frame having frame members corresponding to those of the first frame;

the second frame being hinged to the first frame;

manually operated means on the body for moving the second frame from an open position wherein the two polygonal frames are at an angle with each other for gripping tissue to a closed position with the second frame substantially superposed on the first frame to compress tissue; and

tubular means for urging both frames into their compressed configurations and with the second frame in engagement with the said first frame for inserting the instrument into and removing it from an incision in a patient.

4. An instrument according to Claim 2 wherein the manually operated means for moving the frames between the open and closed positions is a hinged scissors grip.

5. An instrument according to Claim 3 wherein the manually operated means for moving the frames between the open and closed positions is a hinged scissors grip.

6. An instrument according to Claim 1 wherein there are cable operated means for moving the frame members incrementally between the compressed and extended configurations.

7. An instrument according to Claim 2 wherein there are cable operated means for moving the frame members incrementally between the compressed and extended configurations.

8. An instrument according to Claim 3 wherein there are cable operated means for moving the frame members incrementally between the compressed and extended configurations.

9. An instrument according to Claim 1 wherein there are spring means on each frame for moving said frame members from the compressed to the extended positions.

10. An instrument according to Claim 2 wherein there are spring means on each frame for moving said frame members from the compressed to the extended positions.

11. An instrument according to Claim 3 wherein there are spring means on each frame for moving said frame members from the compressed to the extended positions.

12. An instrument according to Claim 3 wherein at least one of the said remaining frame members slides along the said first frame member.

13. An instrument according to Claim 3 wherein at least one of the said remaining frame members is pivotally connected to the said first frame member.

14. An instrument according to Claim 3 wherein at least two of the said remaining frame members are pivoted relative to each other.

15. An instrument according to Claim 3 wherein at least two of the said remaining frame members are spring biased away from each other.

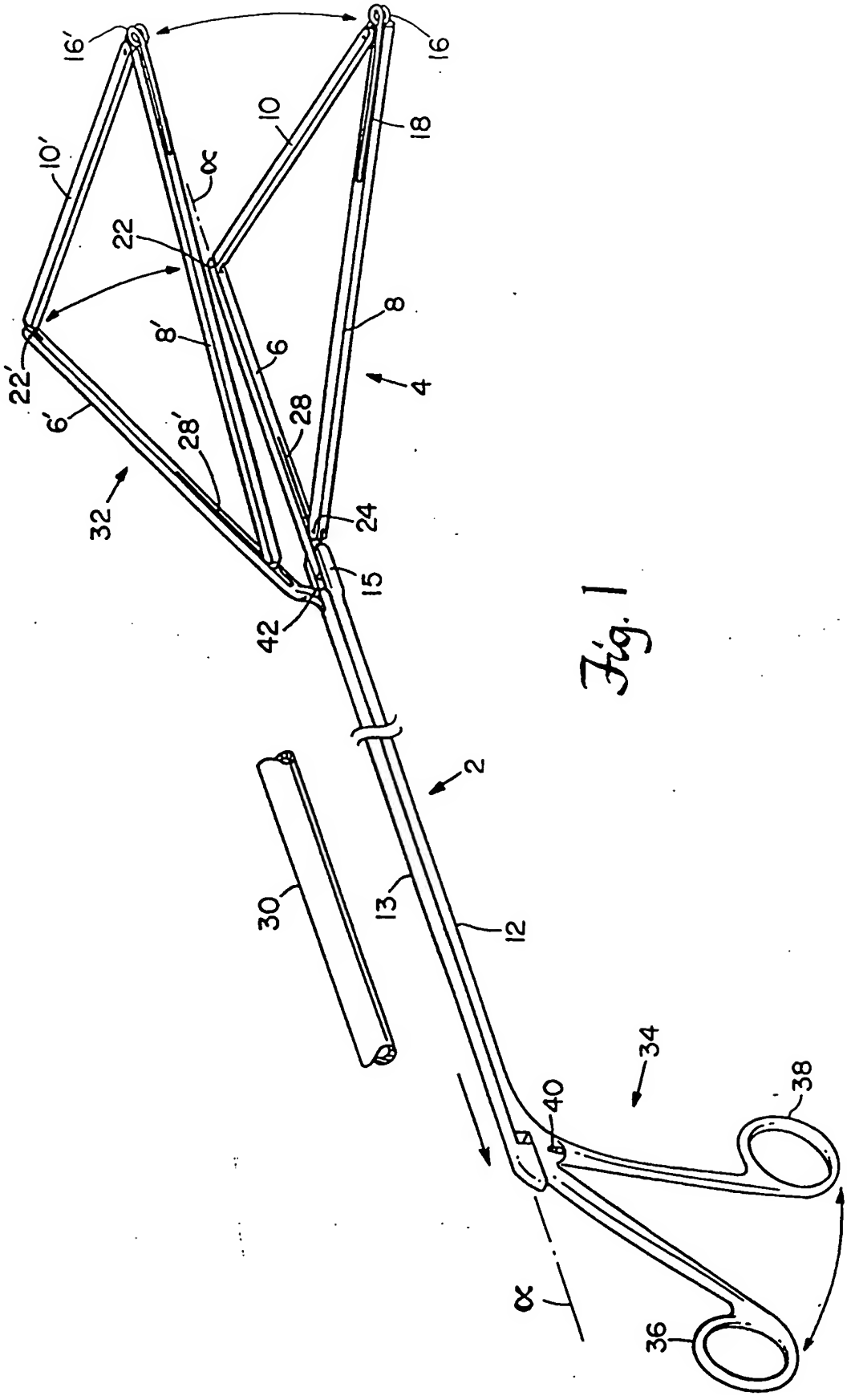

Fig. 1

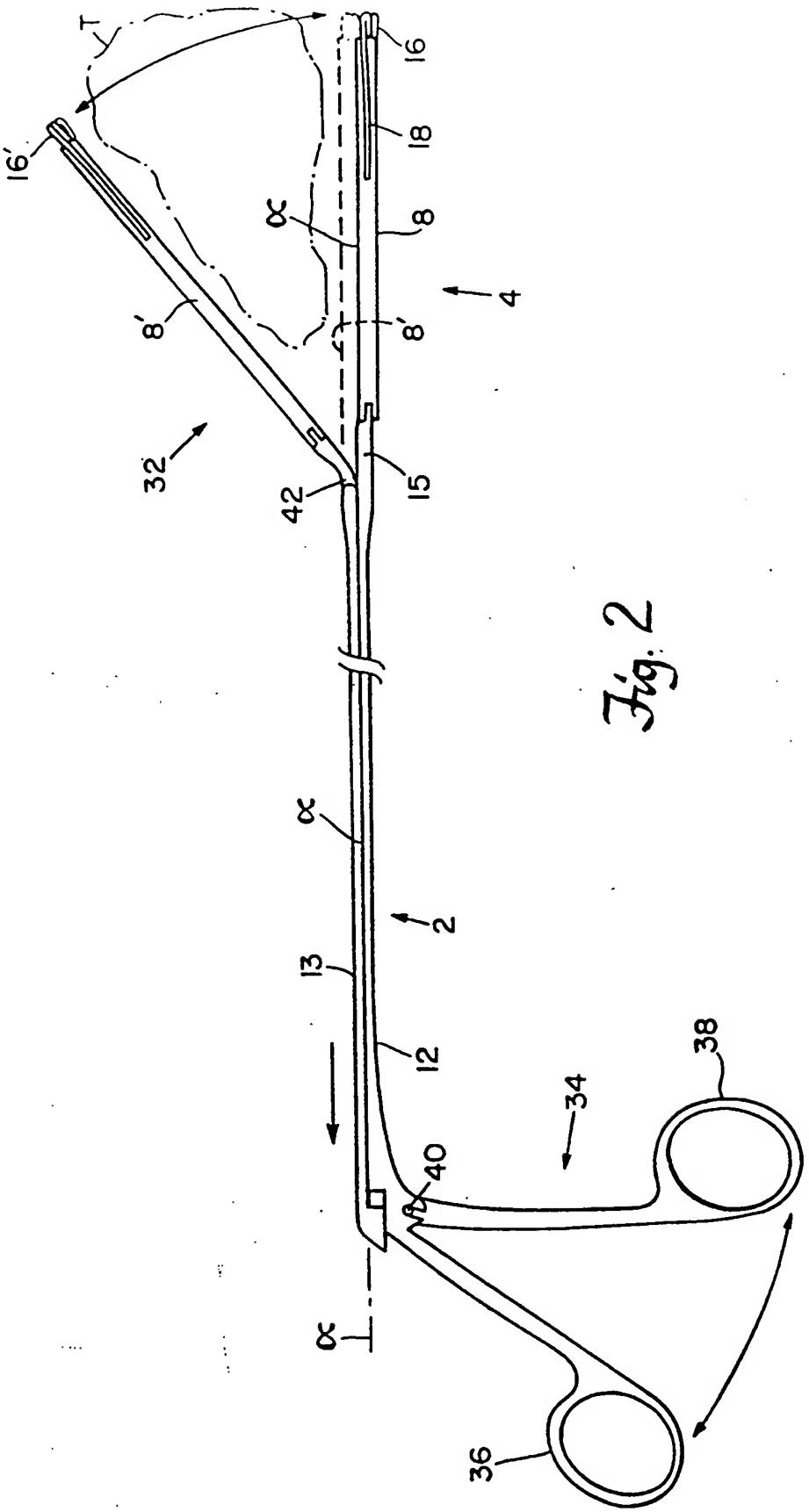

Fig. 2

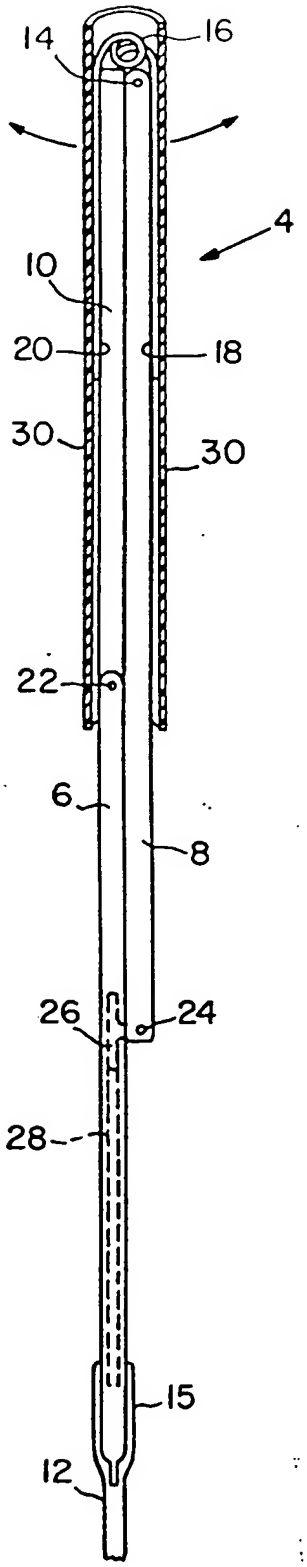
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Fig. 3

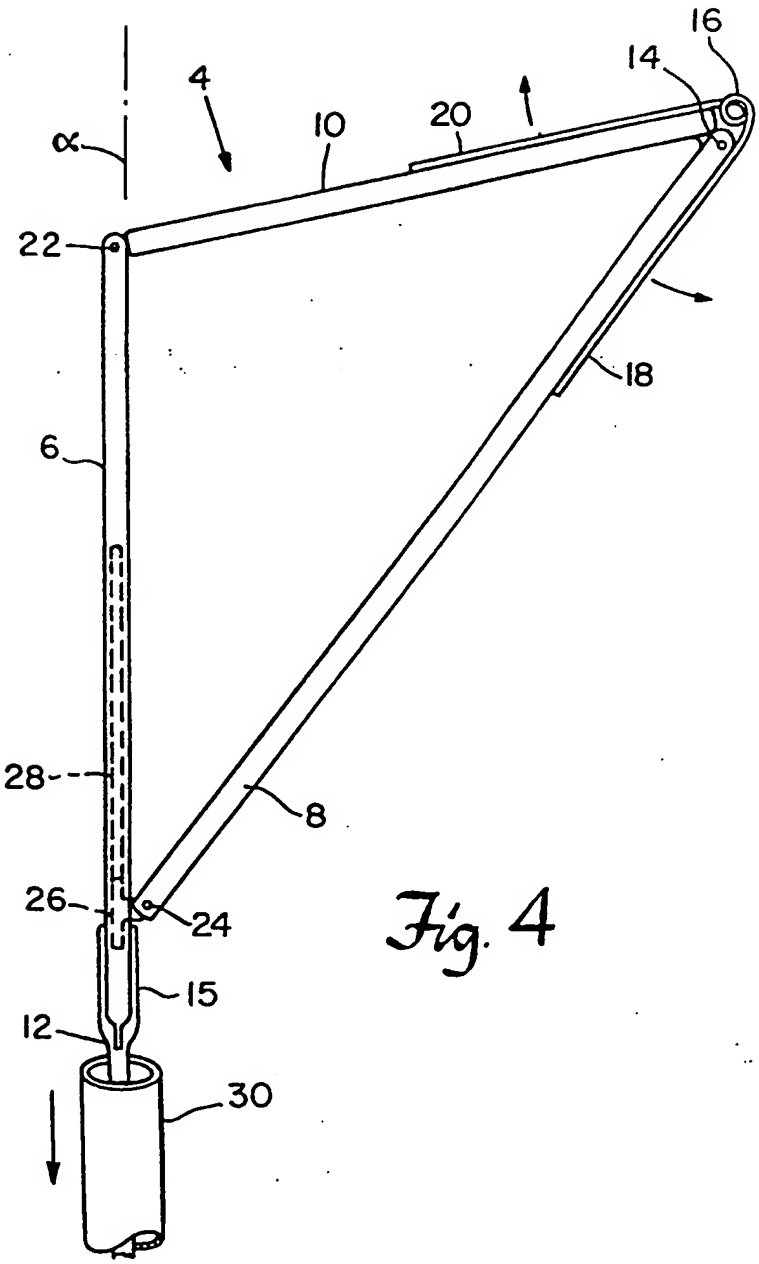
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Fig. 4

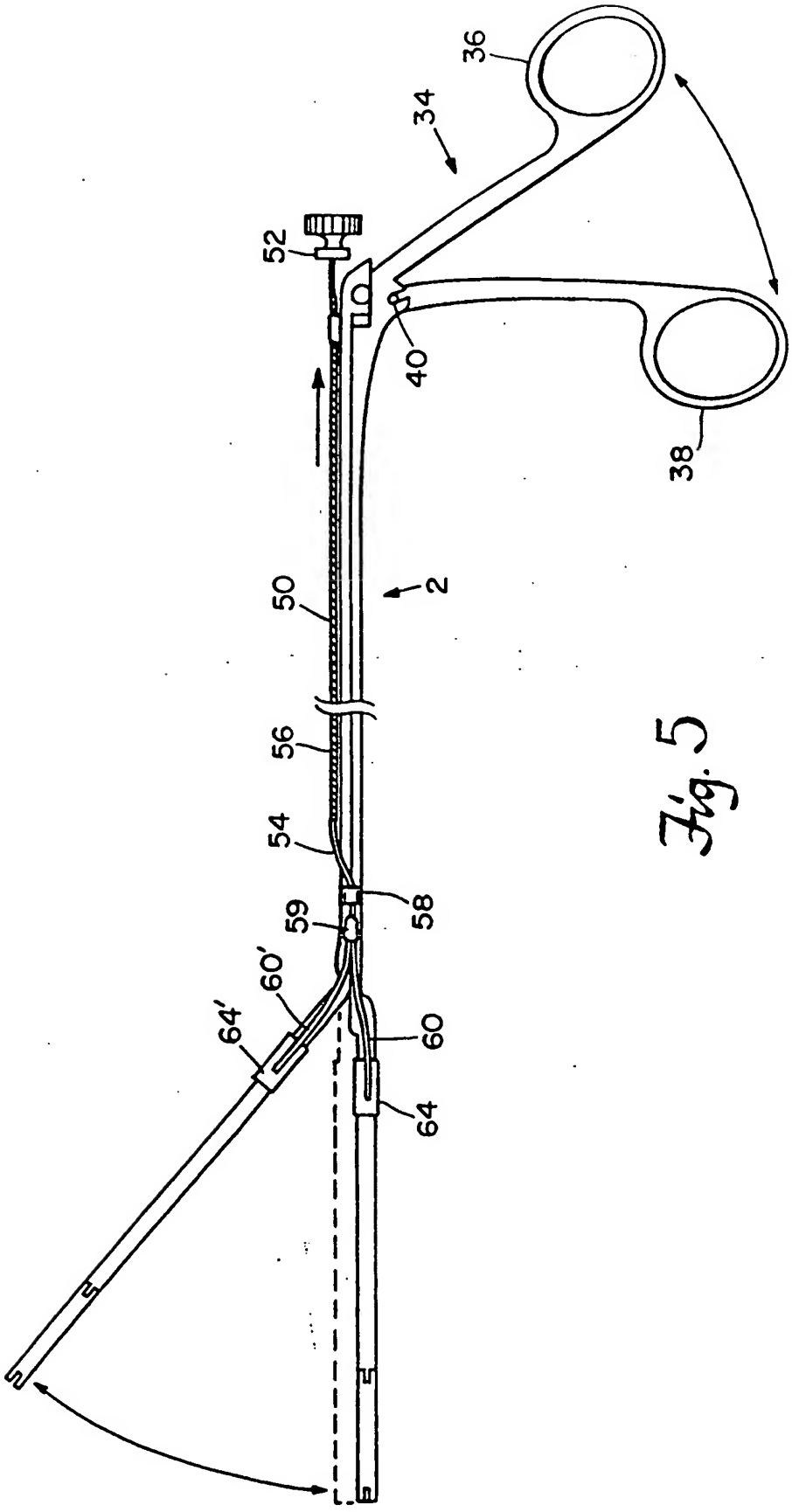

Fig. 5

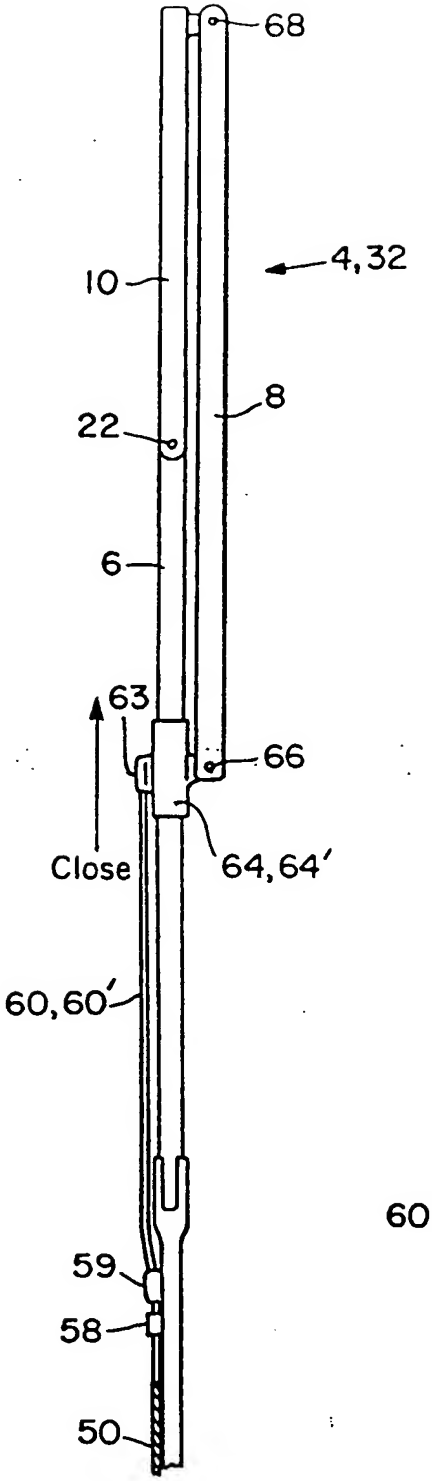
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Fig. 6

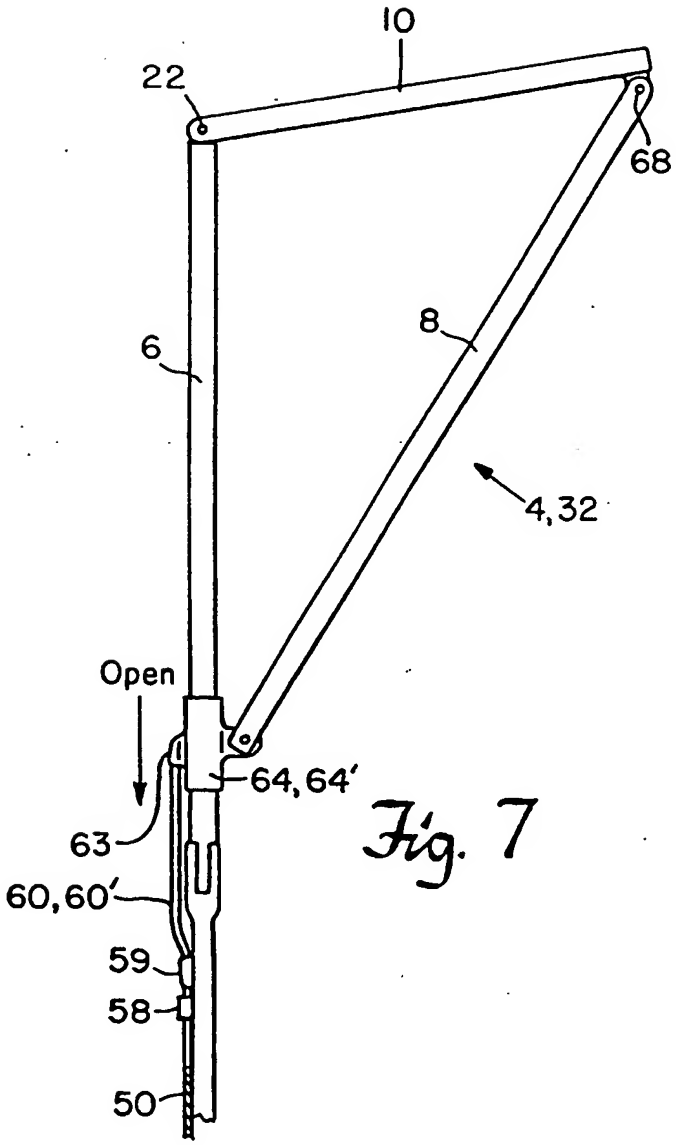
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Fig. 7

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/US 93/07007

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 A61B17/28 A61B17/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 362 113 (SIDERIS) 4 April 1990 see abstract; figures 3,6	1,2,4,6, 7,9,10
A	GB,A,1 509 023 (ALTON OCHSNER) 26 April 1978 see claim 1	1-3
A	US,A,4 369 788 (GOALD) 25 January 1983 see figure 4	4
A	EP,A,0 464 463 (WOLF) 8 January 1992	
A	EP,A,0 449 663 (USSC) 2 October 1991	
P,X	WO,A,93 13712 (MINNESOTA UNIVERSITY) 22 July 1993 see the whole document	1,2,9,10

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☒ Patent family members are listed in annex.

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0362113	04-04-90	US-A-	4917089	17-04-90
GB-A-1509023	26-04-78	NONE		
US-A-4369788	25-01-83	NONE		
EP-A-0464463	08-01-92	DE-A-	4021153	16-01-92
		US-A-	5113846	19-05-92
EP-A-0449663	02-10-91	NONE		
WO-A-9313712	22-07-93	NONE		